

REMARKS:

The Examiner's indication of allowability with respect to claims 1-23 is gratefully acknowledged. However, Applicants respectfully seek clarification from the Examiner as to which claims are currently being allowed. In the section of the Office Action entitled "Allowable Subject Matter", the Examiner notes that "Claims 1-18 and 19-23 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims." However, claims 1 and 19 are independent claims. Did the Examiner intend to say that all of the noted claims are allowable if the rejection of these claims under 35 U.S.C. § 112, second paragraph is overcome, or did he intend to say that some subset of claims 1-23 are currently allowable? If the later, then it would appear that rejection of those claims under 35 U.S.C. § 112, second paragraph was unwarranted.

Reconsideration of the Examiner's rejection of claims 1-23 under 35 U.S.C. § 112, second paragraph as being indefinite is respectfully requested.

As noted in M.P.E.P. § 2171, the appropriateness of a rejection under 35 U.S.C. § 112, second paragraph is evaluated in the context of whether the claim is definite - that is, whether the scope of the claim is clear to a hypothetical person possessing the ordinary level of skill in the pertinent art. As noted in M.P.E.P. § 2173.02, a claim is not indefinite if it apprises one of ordinary skill in the art of its scope and, therefore, serves the notice function required by 35 U.S.C. 112, second paragraph.

In the present case, Applicants respectfully note that the meaning of the phrases noted by the Examiner ("first

liquid composition" and "first etchant") would be clear to one skilled in the art, and hence the scope of the claims would also be clear. Consequently, the claims cannot be considered indefinite. This fact can be appreciated by considering the component words of these phrases.

With respect to the word "first", Applicants respectfully note that it is clear from the claims that this word is merely being used as a modifier to the words "composition" and "etchant", and hence is being used to distinguish, respectfully, the two compositions and two etchants recited in the claim. The use of such ordinal modifiers is quite common in patent claims, and hence its meaning would be clear to one skilled in the art.

With respect to the word "liquid", Applicants note that the meaning of this term is well known to those skilled in the chemical arts. The definition given on Page 679 of Merriam Webster's Collegiate Dictionary, 10th Ed., is representative of how the term is defined in the art: "Having the properties of a liquid: being neither solid nor gaseous." Hence, the meaning of this word is not indefinite.

With respect to the word "composition", Applicants respectfully note that this term is simply the widely used shorthand for the phrase "composition of matter". It is difficult to argue that one skilled in the art would not understand this phrase, given that this very same phrase is used to define the classes of patentable subject matter. Thus, 35 U.S.C. § 101 provides that

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

With respect to the word "etchant", Applicants note that this term is very widely used in the art, and

hence would be well understood by those skilled in the art. In fact, a quick search of the patent data base maintained by the U.S.P.T.O. shows that the term appears in 22,485 issued U.S. patents. U.S. 6,671,301 (Onishi et al.), which relates to the very same art as the present application, is exemplary. The following excerpt, illustrating the use of the word "etchant", is taken from Col. 2, Lines 44-49:

By using the stripe pattern of SiO₂ film 613 as a mask, the p-GaInP band graded layer 607 is etched into a ridge shape by using an acetic acid-type **etchant**. Then, switching to a sulfuric acid-type **etchant**, the p-AlGaInP second cladding layer 606 is etched away until reaching the p-GaInP etching stop layer 605. As a result, a ridge structure composed of the p-GaInP band graded layer 607 and the p-AlGaInP second cladding layer 606 is formed as shown in FIG. 6C. Since the sulfuric acid-type **etchant** has a greater etching rate for the p-AlGaInP second cladding layer 606 than for the p-GaInP etching stop layer 605, the etching process can be successfully stopped at the etching stop layer 605.

In light of the foregoing, it is clear that the meaning of each of the individual words used in the phrases "first liquid composition" and "first etchant" would be clear to one skilled in the art and hence would apprise such a person of the scope of the claims, nor are these words used together in a manner that could be construed to alter the meaning of the words taken in isolation. It is thus respectfully submitted that claims 1-23 are not indefinite.

For the sake of completeness, Applicants acknowledge that the phrases "first liquid composition" and "first etchant" are, by themselves, relatively broad. However, the mere fact that claim terminology may be broad does not render the claim indefinite. This issue is addressed in

M.P.E.P. § 2173.04, which is aptly titled "Breadth Is Not Indefiniteness":

Breadth of a claim is not to be equated with indefiniteness. In re Miller, 441 F.2d 689, 169 USPQ 597 (CCPA 1971). If the scope of the subject matter embraced by the claims is clear, and if applicants have not otherwise indicated that they intend the invention to be of a scope different from that defined in the claims, then the claims comply with 35 U.S.C. 112, second paragraph.

Should the Examiner choose to maintain this rejection, Applicants respectfully request that he further explain the reasoning underlying the rejection, and why the foregoing observations are not dispositive of the issue. This would allow Applicants to respond accordingly, and/or to suggest alternate terminology that would be suitable to the Examiner.

Reconsideration of the Examiner's objection to claim 5 as being of improper dependent form is respectfully requested.

The Examiner argues that claim 5 does not further limit the subject matter of the claim from which it depends. In particular, the Examiner urges that the limitation "the second composition is a dilute aqueous solution" does not further limit the limitation of "the second composition ... comprising HCl and H₂O₂." However, Applicants respectfully note that claim 5 further requires that the solution is dilute, which is a limitation not set forth in the claims from which claim 5 depends. In particular, the previous claims would read on the use of a *concentrated* aqueous solution of HCl with a small amount of H₂O₂ added to it, while claim 5 precludes this possibility. Hence, claim 5 would appear to be of proper dependent form.

Reconsideration of the Examiner's rejection of claim 24 under 35 U.S.C. § 102(b) as being anticipated by Chino (U.S. 2002/0009894) is respectfully requested.

In order to anticipate a claimed invention under 35 U.S.C. § 102(b), a reference must be a statutory bar to the patentability of the claimed invention. Thus, 35 U.S.C. § 102(b) requires that:

the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States

In the present case, Chino is a patent application that was published on January 24, 2002, more than a month after the filing date (December 21, 2001) of the present application.

Accordingly, Chino does not qualify as prior art under 35 U.S.C. § 102(b).

Furthermore, even if Chino was otherwise available as prior art under 35 U.S.C. § 102, it does not anticipate the claimed invention, because it does not teach each and every element of the claimed invention. In particular, contrary to the Examiner's assertion, Chino does not say whether the HCl/H₂O₂ solution used therein is a dilute solution as required by claim 24. Moreover, since there is no particular reason why the solution must be dilute, this property is not inherent in the teachings of Chino.

Reconsideration of the Examiner's rejection of claim 25-28 under 35 U.S.C. § 103 as being unpatentable over Chino (U.S. 2002/0009894) is respectfully requested.

As noted above, Chino is not available as prior art under 35 U.S.C. § 102(b). Since the Examiner's argument is premised on the assumption that Chino is prior art under this section, the Examiner has failed to establish a prima facie case of obviousness.

Moreover, even if Chino was available as prior art under 35 U.S.C. § 102, it would not render the presently claimed invention obvious. As noted above, Chino does not teach the element of a dilute HCl/H₂O₂ solution. This distinction is significant, because Applicants have found that the concentration of the etching solution is critical in terms of the selectivity the solution affords to an InGaP substrate. Thus, as shown in TABLE 2 of the present application, as the etching solution becomes more concentrated than the level shown in EXAMPLE 11 of that table, the selectivity of the solution to InGaP decreases noticeably.

This effect is important because, as noted in the background section of the present application, inconsistency of the etch across the InGaP/GaAs interface has hindered the commercial development of InGaP/GaAs-based HBTs and, as noted in the summary of the invention section, Applicants' invention solves this problem. Chino neither recognizes this problem in the art, nor teaches Applicants' solution to it. Indeed, Chino does not even mention InGaP. Hence, Chino does not render the presently claimed invention obvious.

For the sake of completeness, Applicants also note that Chino does not teach or suggest the claimed ranges of mole ratios of H₂O₂ to HCl. The Examiner concedes this much, but argues that there is no evidence indicating that the claimed ranges of mole ratios of H₂O₂ to HCl is critical or produces any unexpected results. However, as noted above, Applicants have found that only certain aqueous H₂O₂/HCl exhibit high selectivity to InGaP. Since the ratios of H₂O₂ to HCl are material factors in describing these solutions, the Examiner's assertion that this ratio is not critical is unwarranted.

Reconsideration of the Examiner's rejection of claims 29-33 under 35 U.S.C. § 103(a) as being unpatentable over Derwent 2001-317714 (U.S. 6,594,297 (Hayakawa)) is respectfully requested.

In order to support a prima facie case of obvious, a cited reference must teach or suggest each and every element of the claimed invention. However, Hayakawa does not teach or suggest a field effect transistor containing a plurality of epitaxial layers containing a first layer of GaAs and a second layer of InGaP. Hayakawa also does not teach a field effect transistor having an InGaAsP interface, or the step of etching such an interface with a composition comprising an oxidizing agent disposed in a liquid medium. Hayakawa further does not teach the element of an $\text{H}_2\text{O}_2\backslash\text{HCl}\backslash\text{H}_2\text{O}$ etch as required by claim 33.

The Examiner concedes that Hayakawa does not teach a field effect transistor of the type described wherein the second layer comprises InGaP, but argues that the use of InGaP as an active layer in forming a field effect transistor is well known. However, even if this is assumed to be true, this fact alone is insufficient to render the presently claimed invention obvious, because the Examiner has not provided any incentive for one skilled in the art to make the substitution proposed by the Examiner.

Indeed, absent the etch provided by Applicants in the present application, one skilled in the art would have incentive NOT to make the substitution suggested by the Examiner, because the resulting device would suffer from the infirmities noted in the background section of the present application:

Unfortunately, the commercial development of InGaP/GaAs-based HBTs has been hindered for several years by the lack of commercially feasible processes for reliably etching InGaP/GaAs interfaces. While processes and chemistries are known which can be used for etching either InGaP

or GaAs alone, the quality and consistency of the etch becomes an issue when it is necessary to etch across an InGaP/GaAs interface. It has therefore been difficult prior to the present invention to reliably manufacture InGaP/GaAs-based HBTs on a commercial scale. *This is especially true with devices having multiple InGaP/GaAs interfaces.* [emphasis added]

Notably, these problems would not be encountered by using a system based on GaAs/InGaAs layers as taught by Hayakawa. Hence, contrary to the Examiner's assertion, one skilled in the art would have no incentive to make the modification proposed by the Examiner. In the absence of such an incentive, the modification proposed by the Examiner cannot be said to be obvious.

With respect to the element of an $\text{H}_2\text{O}_2\backslash\text{HCl}\backslash\text{H}_2\text{O}$ etch as required by claim 33, as noted above, Hayakawa does not teach this element of the invention. Indeed, Hayakawa does not mention HCl anywhere. Rather, the etch referred to in the cited portion of the reference is a sulfuric acid/ H_2O_2 etch. The Examiner has failed to provide any incentive for one skilled in the art to substitute sulfuric acid in Hayakawa for HCl as required to arrive at the claimed invention and to support a prima facie case of obviousness.

To the contrary, it is well known in the art that the use of sulfuric acid and HCl are not interchangeable in semiconductor etches, because the effectiveness of aqueous H_2O_2 solutions of these two acids in etching various semiconductor materials varies considerably. This is due, among other things, to the differences in solubilities that various semiconductor materials exhibit towards these two acids, as well as to differences in selectivities that these acids exhibit to surrounding substrates.

Reconsideration of the Examiner's rejection of claims 34-35 under 35 U.S.C. § 103(a) as being unpatentable over

Derwent 2001=317714 (U.S. 6,594,297 (Hayakawa)) is respectfully requested.

The infirmities of Hayakawa have been noted above with respect to the rejection of claims 29-33, and are repeated herein. The deficiencies of Hayakawa with respect to claims 34-35 are even more glaring. As noted above, Hayakawa does not teach or suggest the use of etching solutions containing HCl. It thus cannot be claimed that Hayakawa teaches the concentrations of HCl set forth in these claims.

The Examiner concedes that Hayakawa does not teach the recited ranges for the concentration of HCl in the liquid medium, but argues that these ranges are a matter of routine optimization, since there is no evidence to indicate that the recited ranges are critical (the Examiner does not address the fact that HCl is not mentioned in Hayakawa). Applicants respectfully disagree.

As noted in TABLE 2 of the present application, the selectivity of the etch to InGaP drops noticeably if the etching solution is not sufficiently dilute. Hence, the concentration of HCl in the solution is in fact critical. Notably, the claimed ranges for the concentration of HCl correspond to those used in the solution found to exhibit high selectivity to InGaP.

With respect to new claims 36-41 added with this response (support for which may be found at Page 10, Line 18 to Page 11, Line 17), Applicants respectfully note that TABLE 2 of the present application illustrates the importance of the amount of water in solutions used to etch InGaAsP formations. As shown by the data therein, when the HCl/H₂O₂ solutions are not sufficiently dilute, they do not exhibit a good selectivity to InGaP, and thus cannot be used to effectively etch the InGaAsP formations without adversely affecting the quality of the resulting structure. However,

when the amount of water is present at the claimed levels, good selectivity to InGaP is obtained. The claimed subject matter is patentable over the prior art, because neither reference recognizes the criticality of HCl/H₂O₂ concentrations in achieving selectivity to InGaP.

With respect to new claim 42 added with this response, Applicants respectfully note that support for this claim can be found, for example, in the paragraph immediately following TABLE 2. This limitation is significant, because it was Applicants' surprising discovery that the etch used to remove the InGaAsP formations could be made highly selective to InGaP when the components of the etch were controlled within certain ranges of volume ratios or mole ratios (and that, conversely, when the components of the etch fell outside of these ranges, selectivity to InGaP was seen to suffer).

Please charge any payment due with this response (including the payment for additional claims) or credit any overpayment to the deposit account of Hulsey, Grether, Fortkort & Webster, LLP, Deposit Account No. 50-2726. Please reference our docket No. MTRL002USO.

Respectfully submitted,

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